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(54) **A MATERIAL HAVING A HIGH ABSORPTIVE CAPACITY AND AN ABSORBENT STRUCTURE,  
AND AN ABSORBENT PRODUCT WHICH INCLUDES THE MATERIAL IN QUESTION**

**MATERIAL MIT HOHER ABSORPTIONSKAPAZITÄT, ABSORBIERENDE STRUKTUR UND  
ABSORPTIONSPRODUKT MIT DIESEM MATERIAL**

**MATERIAU A HAUTE CAPACITE D'ABSORPTION, STRUCTURE ABSORBANTE, ET PRODUIT  
ABSORBANT CONTENANT LEDIT MATERIAU**

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(56) References cited:  
**WO-A-90/05808**

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## Description

### Background

[0001] The present invention relates to a material having a high absorptive capacity for use in an absorbent structure in an absorbent product such as a sanitary towel, tampon, nappy and the like, to such an absorbent structure, and also to an absorbent product which includes such an absorbent structure. The material is produced from a dry-formed sheet containing at least 70 % flash-dried cellulose fibres and having a grammage of 100-1000 g/m<sup>2</sup> and a density of 0.4-1.2 g/cm<sup>3</sup>.

[0002] Absorbent products of this nature are known in a number of embodiments. Conventionally, the absorptive body in these products is produced by cellulose pulp, in rolls, bales or sheets, for example, being dry-defibred and converted, in fluff form, into a pulp mat, sometimes together with admixture of so-called super-absorbents, which are highly absorbent materials having the ability to absorb several times their own weight of water or body liquid.

[0003] The absorptive body can also contain further constituents, for example in order to improve its liquid-assimilating properties or its liquid-dispersing properties, or to increase its cohesiveness and ability to resist deformation during use.

[0004] In the case of most hygiene products, it is desirable for the product to be thin so that it can be worn as discretely as possible. In order to achieve this, the pulp body is often compressed, partly in order to reduce its bulk and partly in order to increase its liquid-dispersing ability.

[0005] A major problem with these products is that of combining the need to make a thin product with the need to have a high overall absorptive capacity. A substantially greater absorptive capacity can be achieved by adding highly absorbent material to the absorptive body. A method of adding highly absorbent material to an absorbent structure is described in European Patent 122 042, in which a mixture of hydrophilic fibres and super-absorbent particles is air-laid to form a web and compressed to a density of from 0.15 to approximately 1.0 g/cm<sup>3</sup>. The superabsorbent material is normally available in the form of granules or small particles which can be difficult to bind satisfactorily to the absorbent structure. Superabsorbent materials are also expensive, for which reason other solutions have been sought. Furthermore, the majority of superabsorbents are produced from synthetic, non-biodegradable polymers, for example polyacrylates. There is a need, therefore, for materials which have a high absorptive capacity and which at the same time are biodegradable.

[0006] Another problem with hygiene articles is that of so-called rewetting, i.e. when body liquid which has already been absorbed is pressed back towards the skin of the user by external influence, for example when the user sits down. It is, thus, a general requirement that the

side of the product facing the user should be as dry as possible. By means of selecting absorbent materials which bind the absorbed liquid to a high degree, this problem can be reduced.

[0007] Another problem with absorbent structures in hygiene articles is that, at the high densities which are advantageous for liquid dispersal, it tends to be difficult to make such structures sufficiently soft and flexible to meet the high present-day demands for comfort in relation to this type of article.

[0008] Another problem with absorbent structures in hygiene articles is that of achieving high speeds of absorption and rapid assimilation of liquid, especially when repeated wetting occurs. When conventional superabsorbents are used, gel blocking can easily occur in the material, and the speed of absorption decreases with repeated wetting. There has therefore been a demand for highly absorbent materials which do not have any gel blocking tendency.

[0009] It is known from European Patent EP 444 073 to use dry forming in order to manufacture web-shaped pulp for subsequent defibering, so-called dry-formed reel pulp. The strength of the pressed web of flash-dried fibres, having a grammage of 300-1500 g/m<sup>2</sup> and a density of 550-1000 kg/m<sup>3</sup>, is such that the web can be rolled up or handled in sheet form for storage and transport. It is easy to defibre and is normally meant to be converted into fluff form in order to be used for producing absorptive bodies in nappies, sanitary towels and similar products.

### Description of the invention

[0010] As has been previously mentioned, properties which are important for a highly absorbent material in a hygiene product include absorptive speed, absorptive capacity and retentive capacity. In addition, softness and flexibility are important. The principal liquids which are to be absorbed are urine, menstrual blood and blood.

[0011] The object of the present invention is to produce a material having a high absorptive capacity for use in an absorbent structure, in an absorbent product, of the type mentioned at the outset. The material should contribute to the product having a high absorptive speed with rapid assimilation of liquid, especially when repeated wetting occurs. The material should also impart to the product the ability to absorb large quantities of liquid and to bind the liquid in the material; it should ensure that the product exhibits a low degree of rewetting and should enable the product to be very thin, as well as soft and flexible, while retaining a high absorptive capacity. Furthermore, there is a need for the material to have a cost advantage over currently available superabsorbent materials. A further requirement is to produce a highly absorbent absorptive body which is entirely or in the main based on a biodegradable material, for example cellulose fibre.

[0012] The specified requirements have been achieved by the invention, by means of the material of high absorptive capacity produced from a dry-formed sheet as defined in the preamble of the specification and consisting of fragments of the dry-formed sheet, said fragments having a length and width in the main 1-5 mm and the same grammage and density as the dry-formed sheet. The material may subsequently be incorporated, as a part of an absorbent structure, into an absorbent product. The absorbent product then displays, inter alia, a high absorptive capacity while at the same time retaining its flexibility and agreeable comfort properties. In this context, the fragments of dry-formed material can constitute the whole of the absorbent material in the absorbent product or be mixed with other types of absorbent material, for example conventional defibred and fluffed cellulose fibres. A suitable quantity of fragments of dry-formed material is 10-80%, preferably 20-50% and most preferably 30-40%.

[0013] Since the material having a high absorptive capacity is in the form of fragments having a length and width of in the main 1-5 mm, it can readily be incorporated into absorbent products of different shapes, for example body-contoured sanitary towels or nappies. The material can also be readily incorporated into absorbent products of a different type, for example tampons.

[0014] For the present invention, use is made of a dry-formed product which is manufactured from mechanical pulp or chemithemomechanical pulp (CTMP) or an equivalent product which is manufactured from sulphite pulp or kraft pulp, so-called chemical cellulose pulp. Cellulose fibres which have been stiffened chemically can also be used. Other particle-shaped constituents, for example conventional superabsorbent materials, thermoplastic binding fibres and other types of fibres, can also be incorporated into the dry-formed product. The dry-formed product which contains at least 70% flash-dried cellulose fibres is compressed into a sheet having a grammage of 100-1000 g/m<sup>2</sup> and a density of between 0.4-1.2 g/cm<sup>3</sup> and is subsequently finely divided into the previously mentioned fragments having a length and width which is in the main 1-5 mm.

[0015] In the unprocessed state, dry-formed reel pulp has very good absorptive, dispersing and swelling properties, and the material has been found to be very suitable, when finely divided into fragments of a length and width of in the main about 1-5 mm, for being used, as a material having a high absorptive capacity, in hygiene articles. For example, the material exhibits a higher absorptive speed than that of conventional superabsorbents.

[0016] Fragments of dry-formed reel pulp have a structure which is similar to conventional cellulose materials, and the fragments thus bind more readily to the absorbent structure than do conventional superabsorbent materials, thereby helping to ensure, therefore, that these fragments will not be distributed in the production premises during the subsequent process for producing

absorbent hygiene articles nor become redistributed in the finished hygiene article once it has been manufactured. In addition, fragments of dry-formed reel pulp enjoy a substantial cost advantage over conventional superabsorbent materials when the cost is calculated per quantity of absorbed liquid.

[0017] Normally, dry-formed reel pulp has a sheet strength which is sufficient for the product applications which are contemplated here. If the lattice strength should be found to be inadequate for certain product applications, it is possible to increase the said lattice strength by expediently reinforcing the structure by adding reinforcing fibres, binding fibres or binding agents to the cellulose fibre mixture.

[0018] In order to ensure that the fragments of dry-formed reel pulp have the desired properties, the dry-formed pulp mat must have a relatively high density. The density should be 0.4-1.2 g/cm<sup>3</sup>, preferably 0.5-1.1 g/cm<sup>3</sup>, and most preferably 0.8-1.0 g/cm<sup>3</sup>. The grammage is between 100-1000 g/m<sup>2</sup>, preferably 200-800 g/m<sup>2</sup>, and most preferably 300-600 g/m<sup>2</sup>.

[0019] Sheets of dry-formed cellulose pulp can, for example, be manufactured by forming a web of flash-dried fibres of paper pulp in accordance with the method which is described in European Patent EP 444 073.

[0020] Fibres of cellulose pulp have a curl value which describes the degree of curvature of the fibre. The fibres in dry-formed cellulose pulp preferably have a curl value of between 0.20 and 0.40. The curl value can be measured in accordance with the method which is described by B.D. Jordan and N.G. Nguyen in Papper och Trä (Paper and Wood) 4/1986, page 313.

#### Description of the figures

[0021] The invention will be described below in more detail with reference to the attached figures, of which

[0022] Fig. 1 shows a diagrammatic sketch of a reference product (ref. 1) which was used for comparative absorption measurements and which contains conventional cellulose pulp with which conventional superabsorbent materials have been admixed.

[0023] Fig. 2 shows a diagrammatic sketch of a reference product (ref. 2) which was used for comparative absorption measurements and which contains conventional cellulose pulp without any admixture of superabsorbent materials.

[0024] Fig. 3 shows a diagrammatic sketch of an absorbent structure (test) which was used for comparative absorption measurements and which contains conventional cellulose pulp with which a material of high absorptive capacity according to the invention has been admixed.

[0025] Fig. 4 shows the absorption speed in relation to repeated wetting in the case of reference product ref. 1.

[0026] Fig. 5 shows the absorption speed in relation to repeated wetting in the case of reference product ref.

2.

[0027] Fig. 6 shows the absorption speed in relation to repeated wetting in the case of the test product.

[0028] Fig. 7 shows the rewetting which occurs in the case of absorbent structures containing a material according to the invention and conventional cellulose pulp (test) as compared with that in the case of products containing conventional superabsorbent materials and conventional cellulose pulp (ref. 1) and conventional cellulose pulp alone (ref. 2), respectively.

#### Description of the exemplary embodiment

[0029] The following test methods were used in order to evaluate the absorption properties.

[0030] In order to measure absorption speed, 4 volumes of in each case 28 ml of test liquid (0.9% solution of NaCl) were added at 20 min intervals to a test sample. After each addition, the time in seconds which was taken for all the liquid to be absorbed was measured.

[0031] In order to measure rewetting, 4 volumes of in each case 28 ml of test liquid (0.9% solution of NaCl) were added at 20 min intervals to a test specimen. After the last volume of liquid had been absorbed, filter papers were placed over the wet zone and were loaded with a weight of 1.1 kg for 15 sec. The filter papers were weighed before and after the loading and the rewetting was recorded.

[0032] A Mitutoyo thickness gauge was used for measuring the thickness of the material when calculating density.

[0033] An absorbent structure in accordance with Fig. 1 was used as reference product No. 1. The structure consists of two layers, 1 and 2. The first layer 1 consists of a 50/50 mixture of chemithermomechanical cellulose pulp and chemical cellulose pulp having a grammage of 300 g/m<sup>2</sup> and a density of 0.12 g/cm<sup>3</sup>. The second layer 2 consists of a 50/50 mixture of chemithermomechanical cellulose pulp and chemical cellulose pulp having a grammage of 750 g/m<sup>2</sup> and density of 0.17 g/cm<sup>3</sup>. In the middle of layer 2 there is a layer 3 composed of a polyacrylate-based superabsorbent material having a grammage of 200 g/m<sup>2</sup>.

[0034] An absorbent structure according to Fig. 2 was used as reference product No. 2. The structure consists of two layers, 1 and 4. The first layer 1 consists of a 50/50 mixture of chemithermomechanical cellulose pulp and chemical cellulose pulp having a grammage of 300 g/m<sup>2</sup> and a density of 0.12 g/cm<sup>3</sup>. The second layer 4 consists of a 50/50 mixture of chemithermomechanical cellulose pulp and chemical cellulose pulp having a grammage of 750 g/m<sup>2</sup> and a density of 0.17 g/cm<sup>3</sup>.

[0035] An absorbent structure according to Fig. 3 was used as the test product. The structure consists of a layer 5 having a grammage of 1500 g/m<sup>2</sup> and an average density of 0.17 g/cm<sup>3</sup>. The layer 5 consists of a homogeneous mixture of chemical cellulose pulp containing a 35% admixture of material 6 according to the inven-

tion.

[0036] It is evident from Figs. 4, 5 and 6 and Table 1 that an absorbent structure containing material according to the invention exhibits a substantially higher absorption speed in association with repeated wetting than do either of the reference products.

Table 1

Absorption speed, seconds/28 ml			
Wetting	Ref. 1	Ref. 2	Test
1st	3.7	4.4	3.8
2nd	7.7	6.2	4.9
3rd	12.2	11.8	6.8
4th	19.2	24.1	8.7

[0037] It is evident from Fig. 7 and Table 2 that an absorbent structure containing material according to the invention exhibits substantially lower rewetting than do either of the reference products.

Table 2

Rewetting, g		
Ref. 1	Ref. 2	Test
7.3	7.5	3.8

[0038] Naturally, the invention is not limited to the exemplary embodiment shown, but can, of course, be used for other embodiments within the scope of the subsequent patent claims.

#### Claims

1. Material having a high absorptive capacity and which is intended for use in an absorbent structure in an absorbent product, such as a nappy, sanitary towel, tampon and the like, said material being produced from a dry-formed sheet containing at least 70 % flash-dried cellulose fibres and having a grammage of 100-1000 g/m<sup>2</sup> and a density of 0.4-1.2 g/cm<sup>3</sup>, characterized in consisting of fragments (6) of the dry-formed sheet, said fragments having a length and width of in the main 1-5 mm and the same grammage and density as the dry-formed sheet.
2. Material having a high absorptive capacity according to Claim 1, characterized in that the sheet-forming material is compressed to a density of 0.5-1.1 g/cm<sup>3</sup>, preferably 0.8-1.0 g/cm<sup>3</sup>, when the dry-formed sheet is manufactured.
3. Material having a high absorptive capacity according to Claim 1 or 2, characterized in that the dry-formed sheet has a grammage of 200-800 g/m<sup>2</sup>,

preferably 300-600 g/m<sup>2</sup>.

4. Material having a high absorptive capacity according to one or more of Claims 1-3, characterized in that the material has a moisture content of between 3-20%, preferably 4-18%, and most preferably 11-16%, calculated on the total weight of the web, when it is compressed during manufacture of the dry-formed sheet.
5. Material having a high absorptive capacity according to one or more of Claims 1-4, characterized in that the cellulose fibres in the main consist of fibres of pulp produced by the chemithermomechanical route.
6. Material having a high absorptive capacity according to Claims 5, characterized in that the chemithermomechanical pulp fibres have a curl value of between 0.20 and 0.40.
7. Material having a high absorptive capacity according to one or more of Claims 1-4, characterized in that the cellulose fibres in the main consist of fibres of pulp produced by the chemical route.
8. Material having a high absorptive capacity according to one or more of Claims 4-6, characterized in that at least some of the fibres are cellulose fibres which have been stiffened chemically.
9. Absorbent structure (5), characterized in that it contains a material (6) having a high absorptive capacity in accordance with one or more of Claims 1-8 either on its own or together with another absorptive material, for example fluff pulp.
10. Absorbent structure (5) according to Claim 9, characterized in that the proportion of material (6) having a high absorptive capacity is 10-70%, preferably 20-50% and most preferably 30-40%.
11. Absorbent structure (5) according to Claim 9, characterized in that it contains reinforcing agents, for example binding agents, reinforcing fibres or thermoplastic binding fibres.
12. Absorbent product, such as a nappy, sanitary towel, incontinence protection and the like, comprising a liquid-permeable top layer, a bottom layer which is in the main liquid-impermeable, and an absorptive body between these layers, characterized in that the product contains an absorbent structure (5) according to one or more of Claims 9-11.
13. Absorbent product which is intended for absorbing blood, such as a tampon or the like, characterized in that the product contains an absorbent structure

(5) according to one or more of Claims 9-11.

#### Patentansprüche

1. Material, das eine hohe Absorptionskapazität aufweist und zur Verwendung in einer absorbierenden Struktur in einem absorbierenden Produkt, wie beispielsweise eine Windel, eine Damenbinde, ein Tampon und dergleichen, bestimmt ist, wobei das Material aus einer trockengeformten Lage mit wenigstens 70 % schnellgetrockneten Zellulosefasern hergestellt ist und ein Flächengewicht von 100 - 1000 g/m<sup>2</sup> und eine Dichte von 0,4 - 1,2 g/cm<sup>3</sup> aufweist, dadurch gekennzeichnet, daß es aus Fragmenten (6) der trockengeformten Lage besteht, wobei die Fragmente eine Länge und Breite von hauptsächlich 1 - 5 mm haben und das gleiche Flächengewicht und die gleiche Dichte wie die trockengeformte Lage besitzen.
2. Material mit einer hohen Absorptionskapazität nach Anspruch 1, dadurch gekennzeichnet, daß das lagenbildende Material auf eine Dichte von 0,5 - 1,1 g/cm<sup>3</sup>, vorzugsweise 0,8 - 1,0 g/cm<sup>3</sup> zusammengedrückt wird, wenn die trockengeformte Lage hergestellt wird.
3. Material mit einer hohen Absorptionskapazität nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die trockengeformte Lage ein Flächengewicht von 200 - 800 g/m<sup>2</sup>, vorzugsweise 300 - 600 g/m<sup>2</sup> aufweist.
4. Material mit einer hohen Absorptionskapazität nach einem oder mehreren der Ansprüche 1 - 3, dadurch gekennzeichnet, daß das Material einen Feuchtigkeitsgehalt zwischen 3 - 20 %, vorzugsweise 4 - 18 % und am bevorzugtesten 11 - 16 % aufweist, berechnet vom Gesamtgewicht der Bahn, wenn diese bei der Herstellung der trockengeformten Lage zusammengedrückt wird.
5. Material mit einer hohen Absorptionskapazität nach einem oder mehreren der Ansprüche 1 - 4, dadurch gekennzeichnet, daß Zellulosefasern hauptsächlich aus Fasern aus Zellstoff bestehen, der in der chemithermomechanischen Linie hergestellt ist.
6. Material mit einer hohen Absorptionskapazität nach Anspruch 5, dadurch gekennzeichnet, daß die chemothermomechanischen Zellstofffasern einen Curl-Wert zwischen 0,20 und 0,40 besitzen.
7. Material mit einer hohen Absorptionskapazität nach einem oder mehreren der Ansprüche 1 - 4, dadurch gekennzeichnet, daß die Zellulosefasern hauptsächlich aus Fasern aus Zellstoff bestehen, der in

der chemischen Linie hergestellt wurde.

8. Material mit einer hohen Absorptionskapazität nach einem oder mehreren der Ansprüche 4-6, **dadurch gekennzeichnet, daß** wenigstens einige der Fasern Zellulosefasern sind, die chemisch **verstärkt** wurden.
9. Absorbierende Struktur (5), **dadurch gekennzeichnet, daß** sie ein Material (6) mit einer hohen Absorptionskapazität nach einem oder mehreren der Ansprüche 1-8 enthält, **entweder** für sich allein oder zusammen mit anderen absorbierenden Materialien, wie beispielsweise **Fluffzellstoff**.
10. Absorbierende Struktur (5) nach Anspruch 9, **dadurch gekennzeichnet, daß** der Anteil an Material (6) mit einer hohen Absorptionskapazität 10 - 70 %, vorzugsweise 20 - 50 % und am bevorzugtesten 30 - 40 % beträgt.
11. Absorbierende Struktur (5) nach Anspruch 9, **dadurch gekennzeichnet, daß** sie verstärkende Mittel enthält, beispielsweise Bindemittel, Verstärkungsfasern oder thermoplastische Bindfasern.
12. Absorbierendes Produkt, wie beispielsweise eine Windel, eine Damenbinde, ein Inkontinenzschutz oder dergleichen, mit einer flüssigkeitsdurchlässigen Oberschicht, einer Unterschicht, die hauptsächlich flüssigkeitsundurchlässig ist, und einem zwischen diesen Schichten liegenden absorbierenden Körper, **dadurch gekennzeichnet, daß** das Produkt eine absorbierende Struktur (5) nach einem oder mehreren der Ansprüche 9-11 enthält.
13. Absorbierendes Produkt, das zum Absorbieren von Blut bestimmt ist, wie beispielsweise ein Tampon oder dergleichen, **dadurch gekennzeichnet, daß** das Produkt eine absorbierende Struktur (5) nach einem oder mehreren der Ansprüche 9-11 enthält.

#### Revendications

1. Matériau présentant une capacité d'absorption élevée et qui est destiné à être utilisé dans une structure absorbante dans un produit absorbant tel qu'une couche-culotte, une serviette hygiénique, un tampon périodique et autres similaires, ledit matériau étant produit à partir d'une feuille formée à sec contenant au moins 70 % de fibres de cellulose séchées instantanément et présentant un grammage de 100 à 1 000 g/m<sup>2</sup> et une masse volumique de 0,4 à 1,2 g/cm<sup>3</sup>, caractérisé en ce qu'il comprend des fragments (6) de la feuille formée à sec, lesdits fragments présentant une longueur et une largeur essentiellement de 1 à 5 mm, ainsi que le même

grammage et la même masse volumique que la feuille formée à sec.

2. Matériau présentant une capacité d'absorption élevée selon la revendication 1, caractérisé en ce que le matériau formant la feuille est comprimé jusqu'à une masse volumique de 0,5 à 1,1 g/cm<sup>3</sup>, de préférence de 0,8 à 1,0 g/cm<sup>3</sup>, quand on fabrique la feuille formée à sec.
3. Matériau présentant une capacité d'absorption élevée selon la revendication 1 ou 2, caractérisé en ce que la feuille formée à sec présente un grammage de 200 à 600 g/m<sup>2</sup>, de préférence de 300 à 600 g/m<sup>2</sup>.
4. Matériau présentant une capacité d'absorption élevée selon une ou plusieurs des revendications 1 à 3, caractérisé en ce que le matériau présente une teneur en humidité de 3 à 20 %, de préférence de 4 à 18 %, et mieux encore de 11 à 16 %, par rapport au poids total de la nappe, quand on le comprime au cours de la fabrication de la feuille formée à sec.
5. Matériau présentant une capacité d'absorption élevée selon une ou plusieurs des revendications 1 à 4, caractérisé en ce que les fibres de cellulose sont essentiellement des fibres de pâte produite par voie chimico-thermomécanique.
6. Matériau présentant une capacité d'absorption élevée selon la revendication 5, caractérisé en ce que les fibres de pâte chimico-thermomécanique présentent une valeur de frisure de 0,20 à 0,40.
7. Matériau présentant une capacité d'absorption élevée selon une ou plusieurs des revendications 1 à 4, caractérisé en ce que les fibres de cellulose sont essentiellement des fibres de pâte produite par voie chimique.
8. Matériau présentant une capacité d'absorption élevée selon une ou plusieurs des revendications 4 à 6, caractérisé en ce qu'au moins certaines des fibres sont des fibres de cellulose qui ont été rendues rigides chimiquement.
9. Structure absorbante (5), caractérisée en ce qu'elle contient un matériau (6) présentant une capacité d'absorption élevée selon une ou plusieurs des revendications 1 à 8, soit seul, soit associé à un autre matériau absorbant, par exemple, de la pâte fluff.
10. Structure absorbante (5) selon la revendication 9, caractérisée en ce que la proportion de matériau (6) présentant une capacité d'absorption élevée va de 10 à 70 %, de préférence de 20 à 50 %, et mieux encore de 30 à 40 %.

11. Structure absorbante (5) selon la revendication 9, caractérisée en ce qu'elle contient des agents de renforcement, par exemple, des agents liants, des fibres de renforcement ou des fibres liantes thermoplastiques.

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12. Produit absorbant tel qu'une couche-culotte, une serviette hygiénique, une protection contre l'incontinence et autres similaires, comprenant une couche supérieure perméable aux liquides, une couche inférieure essentiellement imperméable aux liquides, et un corps absorbant entre ces couches, caractérisé en ce que le produit contient une structure absorbante (5) selon une ou plusieurs des revendications 9 à 11.

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13. Produit absorbant qui est destiné à absorber du sang, tel qu'un tampon périodique ou autres similaires, caractérisé en ce que le produit contient une structure absorbante (5) selon une ou plusieurs des revendications 9 à 11.

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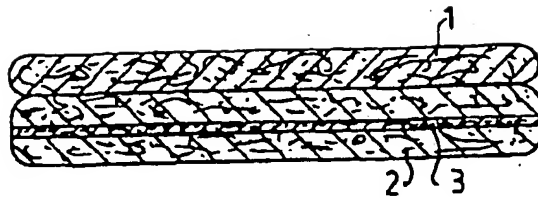


FIG. 1

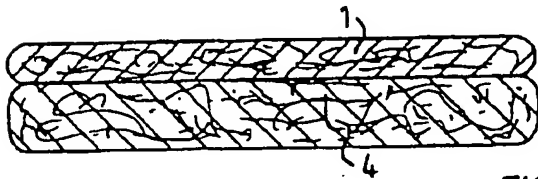


FIG. 2

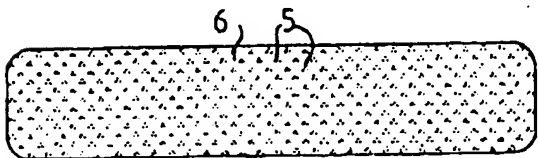


FIG. 3



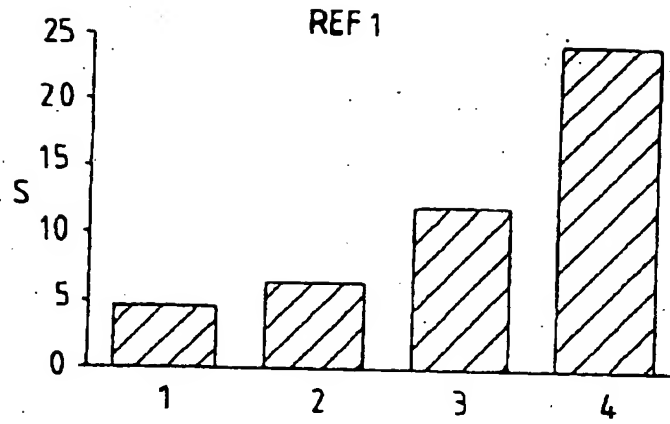


FIG.4

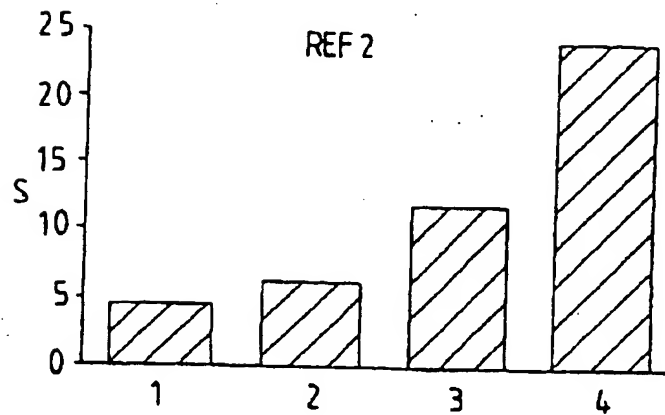


FIG.5

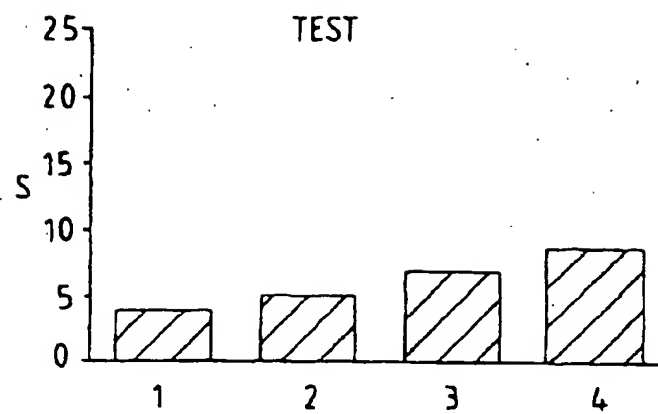


FIG. 6

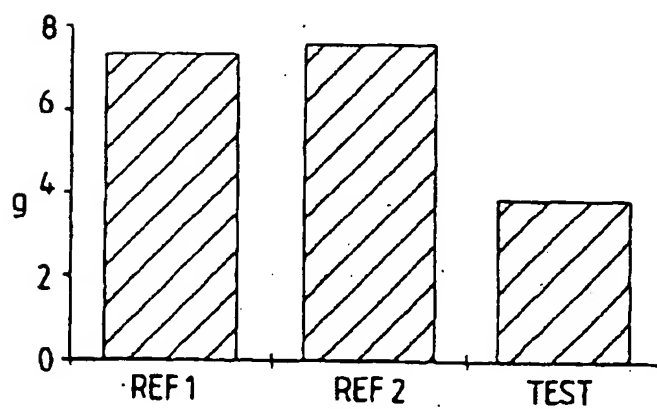


FIG. 7